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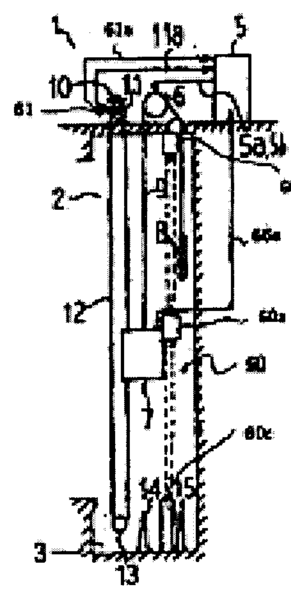
[54] Title of invention: Elevator control device

[57] Abstract

The present invention provides an elevator control device with terminal-segment deceleration control that very precisely sets acceleration in relation to the distance between the elevator cab and the terminal point. It has a position-sensing device (60) for sensing the distance from the top or bottom terminal point in the elevator shaft to the elevator cab, a speed-sensing device (60) for sensing the speed of the cab, an acceleration-sensing device for sensing the acceleration of the cab according to the acceleration level, a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point. The position-sensing device (60) continuously senses the distance of the cab from the terminal point, and said acceleration-sensing device continuously varies the acceleration level according to the distance from the terminal point.



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1. An elevator control device, characterized by the fact that it has:

a position-sensing device for sensing the distance from the top or bottom terminal point in an elevator shaft to a cab;

a speed-sensing device for sensing the speed of an elevator cab;

an acceleration-sensing device for sensing cab acceleration according to the acceleration level;

a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point,

during terminal-segment deceleration control, said position-sensing device continuously senses the distance of the cab from the terminal point, and said acceleration-sensing device continuously varies the acceleration level according to said distance from the terminal point.

2. The elevator control device as described in claim 1, characterized by the fact that said position-sensing device and acceleration-sensing device comprise a shared sensing part that is provided in the cab and in the shaft and that, using laser, sound waves, electrical waves, or light as a sensing media, directly senses the cab speed and the distance between the cab and the terminal point.

3. An elevator control device, characterized by the fact that it has:

a position-sensing device for sensing the distance from the top or bottom terminal point in an elevator shaft to a cab;

a speed-sensing device for sensing the speed of an elevator cab;

an acceleration-sensing device for sensing cab acceleration according to the acceleration level;

a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point,

during terminal-segment deceleration control, said position-sensing device discretely senses the distance of the cab from the terminal point, and having a linear interpolation device that continuously obtains the distance by performing linear interpolation on said discretely sensed distance, and said acceleration-sensing device continuously varying the acceleration level according to the linearly interpolated distance.

4. The elevator control device as described in claim 3, characterized by the fact that said linear interpolation device continuously obtains the speed by interpolating between the discretely sensed distances to the terminal point using integrals of the speeds from the speed-sensing device.

5. An elevator control device, characterized by the fact that it has:

a speed control device for controlling the speed of an elevator cab;

a speed command device for issuing speed instructions;

a position-sensing device for sensing the distance from the top or bottom terminal point in an elevator shaft to a cab;

an acceleration-sensing device for sensing cab acceleration according to the acceleration level;

a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point;

a rated speed-varying device that, based on a rated speed adjustment instruction signal, varies the rated speed of the elevator cab to a speed above the collision speed of the buffer.

6. The elevator control device as described in claim 5, characterized by the fact that said rated speed adjustment instruction signal is based on a signal from any of the following: the cab's internal load, cab starting frequency, or instructions from an external source; said rated speed-varying device being able to increase or decrease the rated speed based on said rated speed adjustment instruction signal.

7. The elevator control device as described in claim 5, characterized by the fact that said acceleration-sensing device sets the acceleration level limit to the maximum value, said maximum value being variable according to the rated speed.

8. The elevator control device as described in claim 5, characterized by the fact that, in the event of said position-sensing device experiencing a fault, said acceleration-sensing device will lower the acceleration level to below the collision speed of the buffers, said deceleration/stopping device lowering the speed of the cab to an acceleration level-limited speed that causes the rated elevator speed generated by said speed command device to drop below the collision speed of the buffers.

9. The elevator control device as described in claim 8, characterized by the fact that it also has a position-sensing device, sensing the compatibility between said position-sensing device and a second position-sensing device belonging to said speed command device, and assessing discrepancies with specified norms as faults, and said rated speed-varying device lowering the acceleration level of said acceleration-sensing device.

Elevator Control Device

Technical Field

The present invention relates to an elevator control device. In particular, it relates to an elevator control device for forcing an elevator to decelerate and stop in the terminal segment.

Background Art

The buffers that are installed in an elevator pit must have sufficient buffer strokes when a cab or counterweight collides with them at full speed because of an operating failure or other cause. This stroke lengthens as the rated speed increases. Thus, it becomes necessary to deepen the pit accordingly. However, when the rated speed rises to a certain level, the required depth of the pit becomes impractical. Therefore, the actual, implemented depth is shallower than what was originally required.

In previous elevator control devices of this type, multiple action points were installed before the terminal segment. Acceleration sensing levels were confirmed at the moments when the position-sensing switch on the side of the cab sensed shaft-side cams of the action points. (For example, refer to Patent Document 1: Japanese Patent Publication Kokai No. 1999-246141.)

Because acceleration is sensed by means of mechanical switches in elevator control devices of this sort, the number of segments is limited. They are thus unable to sense abnormal cab speeds with a high degree of precision and thus cannot force the cab to decelerate and stop in the terminal segment. In addition, because these less precise acceleration levels are used to establish limits on suppressing buffer collision speed, the problem of pre-determining brake torque is much more difficult than usual.

Overview of the Invention

The present invention was made in order to solve the above-described problems. Its object is to provide an elevator control device that performs highly precise terminal-segment speed reduction control corresponding to the distance from the cab to the terminal point.

In view of the described object, the present invention provides an elevator control device, which has: a position-sensing device for sensing the distance from the top or bottom terminal point of an elevator shaft to a cab; a speed-sensing device for sensing the speed of an elevator cab; an acceleration-sensing device for sensing cab acceleration according to the acceleration level; and a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point. During terminal-segment deceleration control, said position-sensing device continuously senses the distance of the cab from the terminal point, and said acceleration-sensing device continuously varies the acceleration level according to said distance from the terminal point.

Simple Description of the Drawings

FIG. 1 is a cut-away view of the elevator shaft of the elevator control device of one embodiment of the present invention.

FIG. 2 is a functional block diagram representing the structure of a terminal-segment deceleration control part within a computer within the control panel of FIG. 1.

FIG. 3 is a motion diagram used to explain the elevator control device of the present invention.

FIG. 4 is a motion diagram used to explain the elevator control device of the present invention.

FIG. 5 is a cut-away view of the elevator shaft of the elevator control device of another embodiment of the present invention.

FIG. 6 is a functional block diagram representing the structure of a terminal-segment deceleration control part within a computer within the control panel of FIG. 5.

FIG. 7 is a structural diagram used to explain the discrete position-sensing device of FIG. 5.

FIG. 8 is a structural diagram used to explain the discrete position-sensing device of FIG. 5.

FIG. 9 is a structural diagram used to explain the discrete position-sensing device of FIG. 5.

FIG. 10 is a functional block diagram representing the structure of a control part consisting of a computer within the control panel within the elevator control device of another embodiment of the present invention.

FIG. 11 is a motion diagram used to explain the elevator control device of the present invention.

FIG. 12 is a motion diagram used to explain the elevator control device of the present invention.

Embodiments of the Present Invention

[Embodiment 1]

FIG. 1 is a cut-away view of the elevator shaft of the elevator control device of one embodiment of the present invention. The elevator basically consists of the machinery room 1, the shaft 2, the pit 3 located at the bottom of the shaft 2, and the various equipment thereon, which is controlled by the control panel 5. The cab 7 and the counterweight 8 are connected to each of the two sides of the main cable 9 that hangs from the hoist 6 that is controlled by the control signals 5a and the brake signals 5b that originate in the control panel 5. In addition, the governor 10, with the governor cable 12 that is attached to two sides of the cab 7 and that is tensioned with the tensioning wheel 13, is provided with a speed sensor 11 and a motion quantity sensor 61 that consist of rotating coders that generate speed sensing signals 11a and motion quantity sensing signals 61a.

In the pit 3, there are buffers 14 and 15 that buffer collisions by the cab 7 and the counterweight 8. The position/speed-sensing device 60 includes sensing parts 60a, 60b and 60c, which are installed on the cab 7 and the shaft 2. They generate laser beams, sound waves, electric waves, or light as their sensing medium and receive the reflected waves, or they then use Doppler Effect to directly sense the speed of the cab and the distance of the cab from the top or bottom terminal point (the position of the cab). The result is the device consisting of the position-sensing device 60 and the speed-sensing device 60. The sensing part 60a that is installed on the cab 7 supplies sensing signals 66a (including distance and speed signals) to the control panel 5. FIG. 2 is a functional block diagram representing a terminal-segment deceleration control part 500 within a computer within the control panel 5. In the present embodiment, the terminal-segment deceleration control part 500 has an acceleration-sensing device 502 and a deceleration/stopping device

504. The acceleration-sensing device 502 is a device which generally indicates the sensed acceleration when the cab speed is above the acceleration level. It continuously varies the acceleration level according to the distance between the cab and the terminal point as continuously sensed through the sensing signals 66a of the position/speed-sensing device 60. When cab speed, as determined by the acceleration-sensing device 502 according to the cab-terminal distance, exceeds the acceleration level, the deceleration/stopping device 504 forces the cab to decelerate/stop. In addition, the speed-sensing signal 11a can be used as a cab speed signal to substitute for the speed sensing in the position/speed sensing device 60.

FIG. 3, in which the horizontal axis represents time, shows: the elevator speed sensed as the elevator travels (indicated by A), the continuously sensed distance of the elevator from cab to terminal point (indicated by B), the discretely sensed distance of the elevator from cab to terminal point (indicated by C), and the acceleration sensing level at which speed can be reduced to below the permissible collision speeds of the buffers 14 and 15 by means of the terminal-segment deceleration control devices sensing acceleration and activating braking (indicated by D). In FIG. 4, the horizontal axis represents the cab-to-terminal point distance. It shows: the general deceleration curve relative to distance (indicated by E), the acceleration sensing level relative to the continuously-sensed distance from cab to terminal (indicated by F), and the acceleration sensing level relative to the discretely-sensed distance from cab to terminal (indicated by G).

The terminal-segment deceleration override control in the present embodiment uses the position-sensing device 60 to continuously detect the cab-to-terminal point distance. The sensed distance to terminal point is sent to the terminal-segment deceleration control part 500 of the control panel 5. In the terminal-segment deceleration control part 500, the acceleration level is continuously varied according to the cab-terminal point distance continually sensed by the sensing signals 66a from the acceleration-sensing device 502 and the position/speed-sensing device 60. In other words, for elevators whose rated speed is higher than the maximum rated speed of the buffers 14 and 15, an override deceleration mode is established to lower the cab speed before it collides with the buffers 14 and 15. The deceleration/stopping device 504 activates the hoist 6 brake (not shown). It forces the cab to decelerate/stop when the acceleration level determined by the acceleration-sensing device 502 according to the cab-terminal point distance is exceeded. The acceleration-sensing device level limits the acceleration level to the maximum acceleration sensing level. This maximum value varies according to the rated speed.

As described above, the present embodiment establishes an override deceleration mode that lowers cab speed prior to collision with the buffers in an elevator whose rated speed is higher than the maximum rated speed of the buffers. Because past work that was performed using the levels of a few segments is made into continuous values using a position-sensing device that uses laser, sound waves, electric waves, or light as its sensing media, it becomes possible to minimize the cab speeds at which the brakes are activated and to set the acceleration precisely according to the cab-to-terminal point distance.

[Embodiment 2]

FIG. 5 is a cut-away view of the elevator shaft of the elevator control device of another embodiment of the present invention. The same numbers will be used to indicate parts that are the same as or equivalent to parts in the above-described embodiment. FIG. 5 does not have the position/speed-sensing device 60 of FIG. 1. Rather, it has the discrete position-sensing device 122 that discretely senses the

elevator cab position and that consists of: the board sets 104-108 that, installed on a side of the shaft 2, sense the distance from the cab to the terminal point and perform position-sensing, and the position-sensing device 102 including the multiple position-sensing parts (see 103a-f of FIGS. 7-9) that are installed on a side of the cab 7. In addition, the distance-sensing device 110 calculates integrals from the speed sensing signals 11a that are sensed by the speed sensor 11, calculates the travel distances, and outputs travel distance signals 110a.

In addition, FIG. 6 shows the functional structure of the terminal-segment deceleration control part 500 consisting of the computer in the control panel 5 in the present embodiment. The terminal-segment deceleration control part 500 has and employs an acceleration-sensing device 502a, a deceleration/stopping device 504a, and a linear interpolation device 111. The linear interpolation device 111 uses the travel distance signals 110a from the distance-sensing device 110 to perform linear interpolation on discretely sensed cab-to-terminal point distances. The acceleration-sensing device 502a , with multiple acceleration-sensing action points, discretely varies the acceleration level according to the discretely-sensed cab-to-terminal point distances generated by the sensing signals 102a from the discrete position-sensing device 122. In this case, the linear interpolation device 111 continuously varies the acceleration level in relation to the linearly-interpolated distances. When cab speed exceeds the acceleration level as determined by said acceleration-sensing device 502a according to the cab-to-terminal point distance, the deceleration/stopping device 504a forces the cab to decelerate/stop. FIGS. 7-9 show the relationship between the board sets 104a-108c of the discrete position-sensing device 122 and the position-sensing parts 103a-f of the position-sensing device 102. The figures are the total front view and a combination of front and overhead views, respectively. The figures show 5 action points, but any number of points can be chosen. The number of position-sensing parts 103 of the position-sensing device 102 and board sets 104a-108c can be increased or decreased accordingly.

In FIG. 7, the elevator cab 7 ascends and descends along the elevator shaft 2. The arms 109a-109e that project in a horizontal direction are arranged from 109a at the bottom to 109e at the top, and all have the same lengths. Boards 104a-104c, 105a-105c, 106a-106c, 107a-107c, and 108a-108c are installed vertically and relative to the paper [sic] on each arm 109a-109e, respectively. In addition, each action point is encoded. Although the position-sensing parts 103a-103f of the position-sensing device 102 make use of magnetic parts, they can be used as parts that use laser, sound waves, electric waves, or light as their sensing medium. As shown in FIGS. 8 and 9, when at each action point the boards 104a-108c fit into (slide into) the]-shaped depressions of the position-sensing parts 103a-103f, the parts become inactive because of magnetic shields. They generate the sensing signals 102a, sent as a set from the inactivated position-sensing parts 103a-103f, and the terminal-segment deceleration control part 500 shown in FIG. 6 senses the arrival at each action point.

FIG. 3 shows the sensed elevator speed A as the elevator cab 7 travels and the discretely sensed elevator cab-to-terminal point distance C. FIG. 4 shows the general deceleration curve E relative to the cab-to-terminal point distance, and the acceleration sensing level G relative to the discretely sensed cab-to-terminal point distance. The terminal-segment override deceleration control of the present embodiment makes use of the discrete position-sensing device 122 to discretely sense the cab-to-terminal point distance. In addition, integrals are taken of the speeds sensed using the speed sensor 110, the distance-sensing

device 11 (which calculates travel distances) is used to sense the travel distance, and the linear interpolation device 111 (see FIG. 6) is used to linearly interpolate the discretely sensed cab-to-terminal point distance according to travel distance. During this linear interpolation, the distance to the terminal point at the time that a position is sensed serves as the benchmark distance. Subsequently, the travel distance is calculated on the basis of speed data obtained from the speed-sensing signals 11a, and after subtracting said distance to the terminal point, the result is the cab position.

The acceleration-sensing device 502a senses acceleration based on linear interpolation and continuously interpolated distances to the terminal point. The deceleration/stopping device 504a acts as the hoist 6 brake (not shown). It can continuously vary the acceleration sensing level (see D in FIG. 3) (which permits deceleration) to below the permitted collision speeds of the buffers 14 and 15. The acceleration level is limited by the acceleration-sensing device 502a according to the maximum acceleration sensing level. Said maximum value varies according to the rated speed.

As described above, in the present embodiment, the discrete position-sensing device discretely senses elevator cab positions. Because the linear interpolation device obtains continuous distances by performing linear interpolation on these discretely sensed distances, and because the acceleration level is made to vary continuously in relation to these linearly interpolated distances, it becomes possible to minimize the cab speeds at which the brake is activated and to set the acceleration precisely according to the cab-to-terminal point distance.

[Embodiment 3]

FIG. 10 shows a functional diagram of a control part 600 consisting of a computer within the control panel 5 in the elevator control device of another embodiment of the present invention. The overall elevator structure can be depicted by either FIG. 1 or FIG. 5. In FIG. 10, the speed control device 602, based on signals from the speed command device consisting of the speed sensor 11 and the motion quantity sensor 61 (FIGS. 1 and 5) , which indicate elevator speed, and the distance-sensing device 110 (FIG. 5), outputs control signals 5a and braking signals 5b, and performs general elevator cab speed control, which entails control of the hoist 6. The acceleration-sensing device 604 senses cab acceleration by comparing cab speed to the acceleration level. As the cab approaches the terminal point of the shaft, the deceleration/stopping device 606 forces the cab to decelerate/stop when the cab travel speed exceeds the acceleration level determined according to the distance to the terminal point by the acceleration-sensing device 604. The rated speed-varying device 608, based on the below-described rated speed adjustment instruction signal 300, varies the rated speed of the elevator cab to a speed above the collision speed of the buffers. In addition, the position-detecting device, which detects the distance from the top and bottom terminal points of the elevator shaft to the cab, may be the position/speed-sensing device 60 or the discrete position-sensing device 122 in FIGS. 1 or 5 or another form of device.

The rated speed adjustment instruction signal 300 is based on cab load (e.g., the cab operates according to a high rated-speed mode when internal cab load is light; it operates at a low rated-speed mode when load is heavy) or time segment start frequency (e.g., the cab operates according to a high rated-speed mode when start frequency is high; it operates at a low rated-speed mode when frequency is low) signals, or the signals obtained when, for example, a passenger presses a button or switch outside (not shown). These are signals that are instructions for the speed to be raised or lowered. (a) in FIG. 11 shows a high

rated-speed mode, (b) shows a high rated-acceleration mode, (c) shows a low rated-speed mode, and (d) shows a low-rated acceleration mode. In this case, the rated speed occurs in two stages: high and low, but several stages may be used. The rated speed-varying device 608 varies the rated speed based on the rated speed adjustment instruction signals 300. The acceleration sensing device 604 uses the maximum acceleration sensing level to limit the acceleration level, and this maximum can vary according to rated speed. FIG. 12 shows the acceleration sensing level A and speed mode B when the rated speed is high and the acceleration sensing level C and the speed mode D when the rated speed is low. In addition, R indicates the deceleration curve during normal operation.

As described above, in the present embodiment, the rated speed of the elevator cab can, based on the cab's interior load, start frequency, or external instructions, be varied to speeds above the collision speed of the buffers. Thus, since the elevator speeds at which the brake is activated are minimized, the elevator can operate with high efficiency.

[Embodiment 4]

In another embodiment of the elevator control device of the present invention, when the position-sensing device which consists of the speed-sensing device 60 (FIGS. 1 and 5) and the discrete position-sensing device 122 experiences a failure, the acceleration-sensing device 604 (in the control part 600 consisting of the computer within the control panel 5 in FIG 10) lowers the acceleration level to below the buffer collision speed, and the deceleration/stopping device 606 lowers the cab speed to the acceleration level-limited speed, i.e. the elevator rated speed generated by the speed instruction device (consisting of the speed sensor 11 and the motion quantity sensor 61 (FIGS. 1 and 5) and the speed-sensing device 110) is lowered below the bumper collision speed.

A position-sensing device 610 is installed to detect faults. The position-sensing device 610 compares the distance to the terminal point (corresponding to sensing signals 66a and 102a) sensed using the position-sensing device (for terminal-segment deceleration control) consisting of the position/speed-sensing device 60 and the discrete position-sensing device 122 (FIGS. 1 and 5) with the present cab 7 position (corresponding to 61a) calculated from the motion sensing signals 61a from the motion quantity sensor 61 contained in the speed instruction device. When the difference is above a specified value, it diagnoses abnormal operation of the position-sensing device consisting of the position/speed sensing device 60 and the discrete position sensing device 122 and, using the rated speed-varying device 608, lowers the acceleration level in the acceleration-sensing device to below buffer collision speed.

As described above, in the present embodiment, when the position-sensing device fails, the acceleration-sensing device, by means of the rated speed-varying device, lowers the acceleration level to below buffer collision speed. In addition, safety can be assured because the deceleration/stopping device lowers cab speed to the acceleration level-limited speed, i.e. the elevator rated speed generated by the speed instruction device is lowered to below the bumper collision speed.

In view of the object that has been described, the elevator control device of the present invention has: a position-sensing device for sensing the distance from the top or bottom terminal point in an elevator shaft to a cab; a speed-sensing device for sensing the speed of an elevator cab; an acceleration-sensing device for sensing cab acceleration according to the acceleration level; a deceleration/stopping device for forcing the cab to decelerate and stop when, as the cab approaches the terminal point of the shaft, the operating speed of the cab exceeds the acceleration level determined by said acceleration-sensing device for the distance from the terminal point. During terminal-segment deceleration control, said position-sensing device continuously senses the distance to the terminal point, and said acceleration-sensing device continuously varies the acceleration level according to said distance from the terminal point. In this way, it is possible to provide an elevator control device that minimizes the cab speeds at which the brake is activated and that sets acceleration precisely according to the distance from the cab to the terminal point.

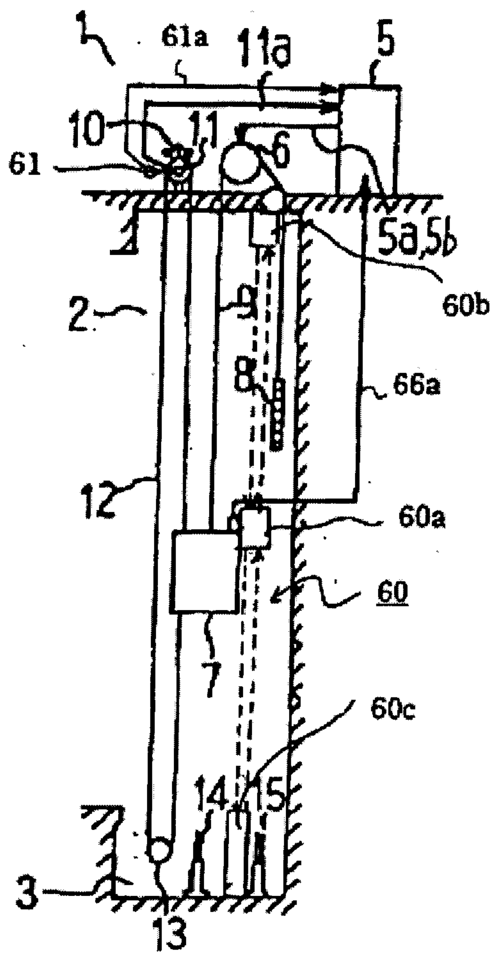

FIG. 1

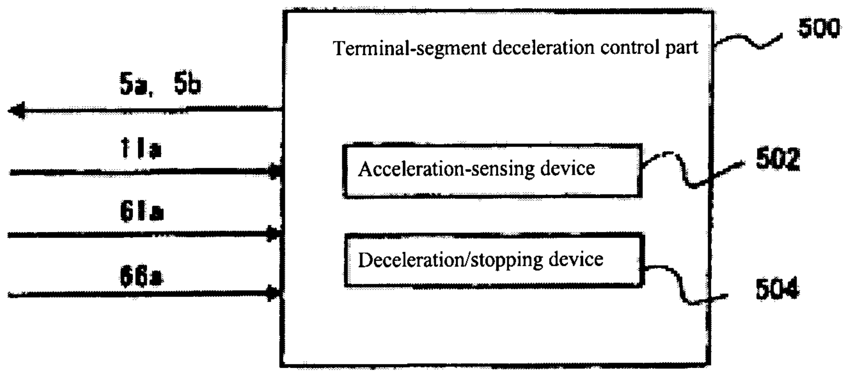
Terminal-segment deceleration control part
500
5a, 5b
11a
61a
66a
Acceleration-sensing device
502
Deceleration/stopping device
504

FIG. 2

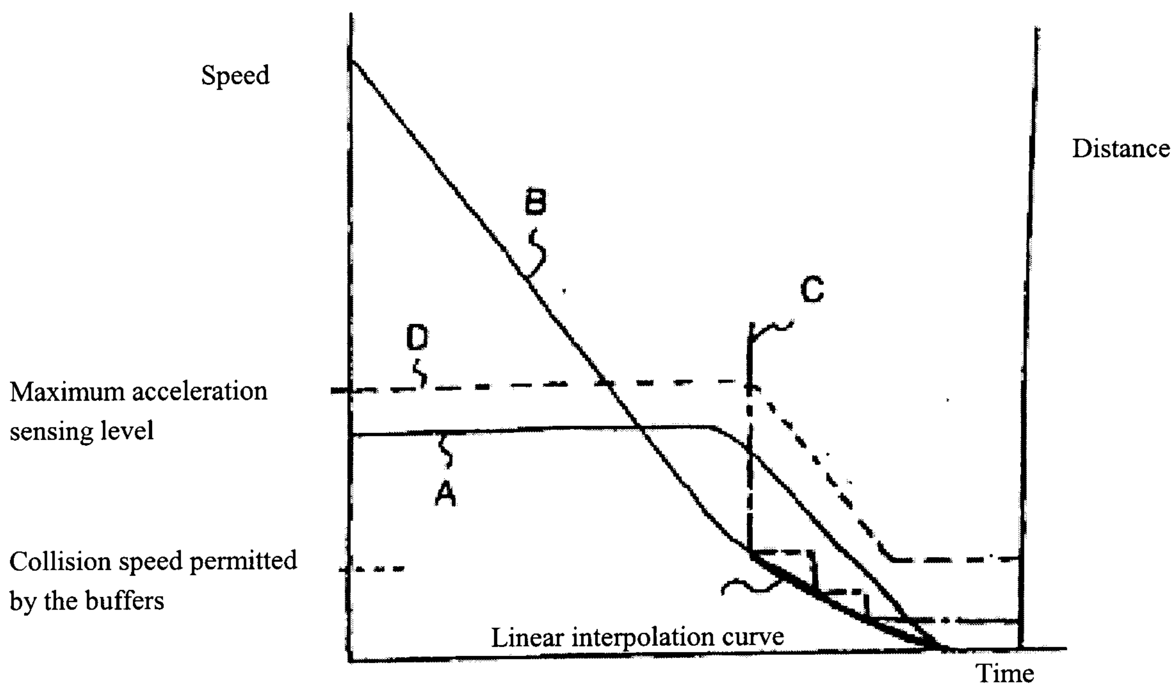
Speed
Distance
B
C
D
Maximum acceleration sensing level
A
Collision speed permitted by the buffers
Linear interpolation curve
Time

FIG. 3

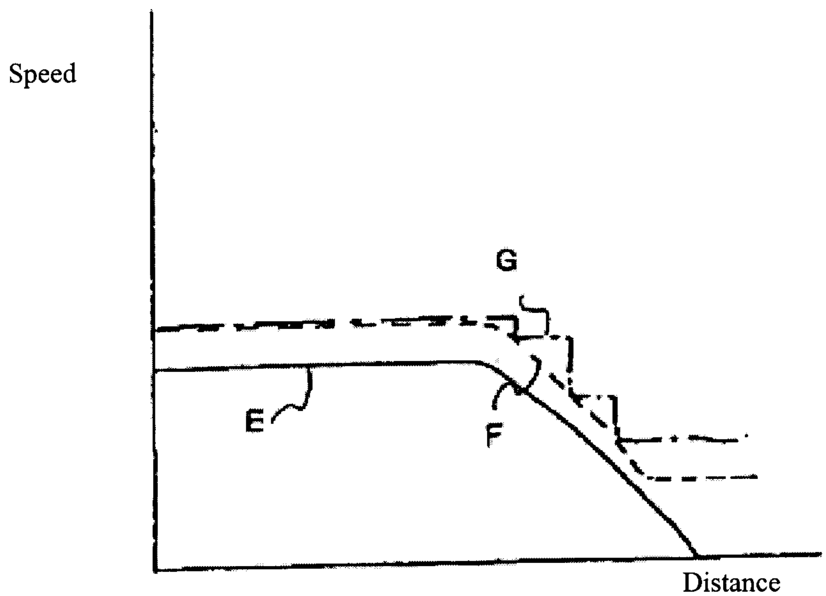

FIG. 4

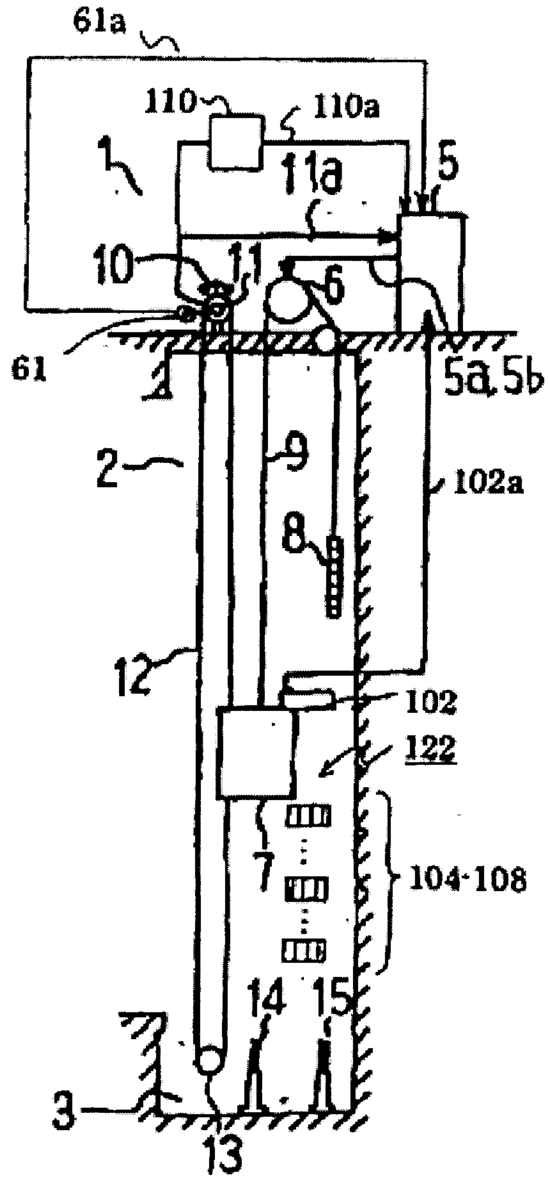
61a
110
110a
1
11a
5
10
11
6
61
5a,5b
2
9
102a
8
12
102
122
7
104-108
14
15
3
13

FIG. 5

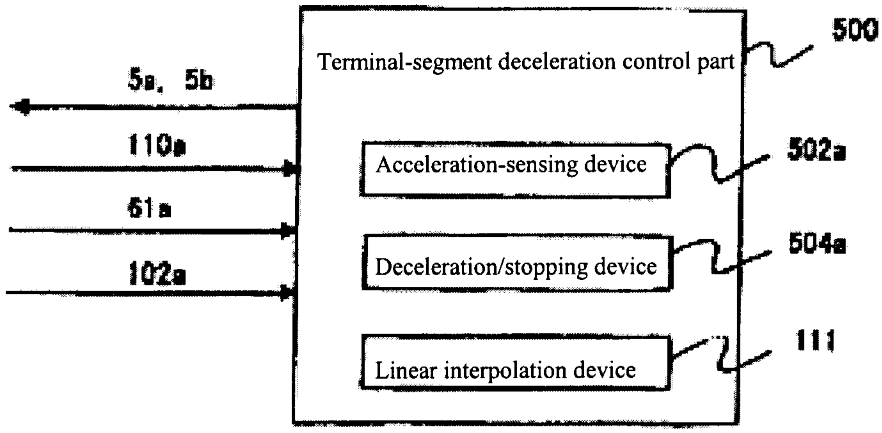
Terminal-segment deceleration control part
500
5a, 5b
110a
61a
102a
Acceleration-sensing device
502a
Deceleration/stopping device
504a
Linear interpolation device
111

FIG. 6

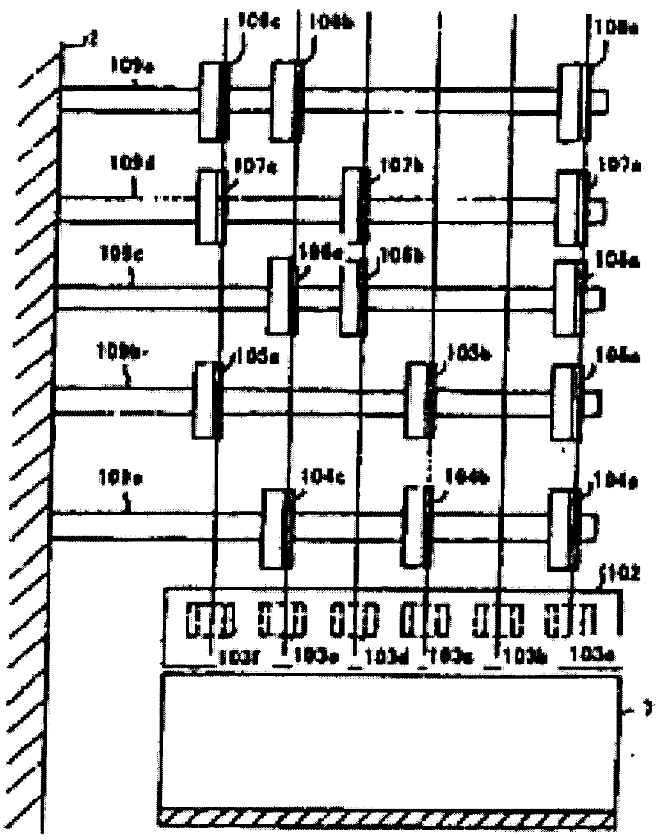

FIG. 7

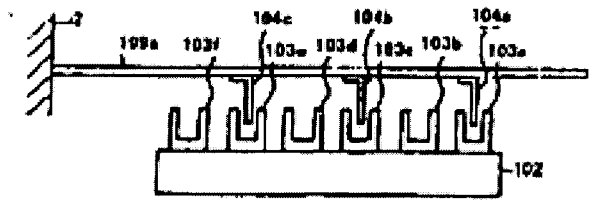

FIG. 8

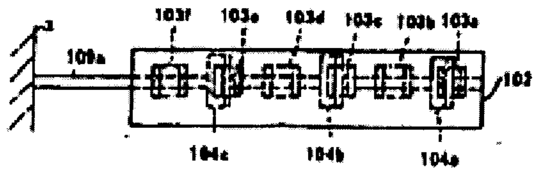

FIG. 9

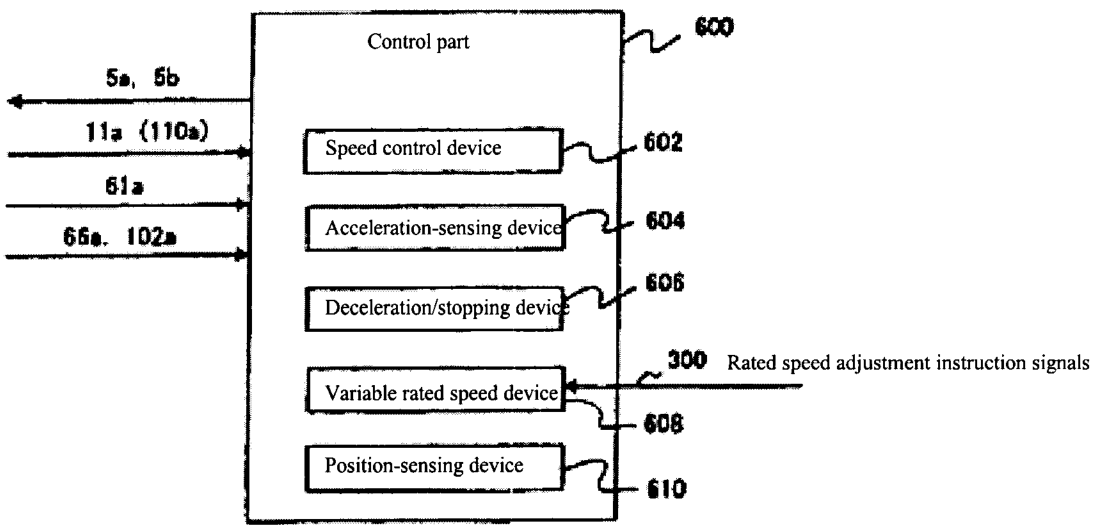

FIG. 10

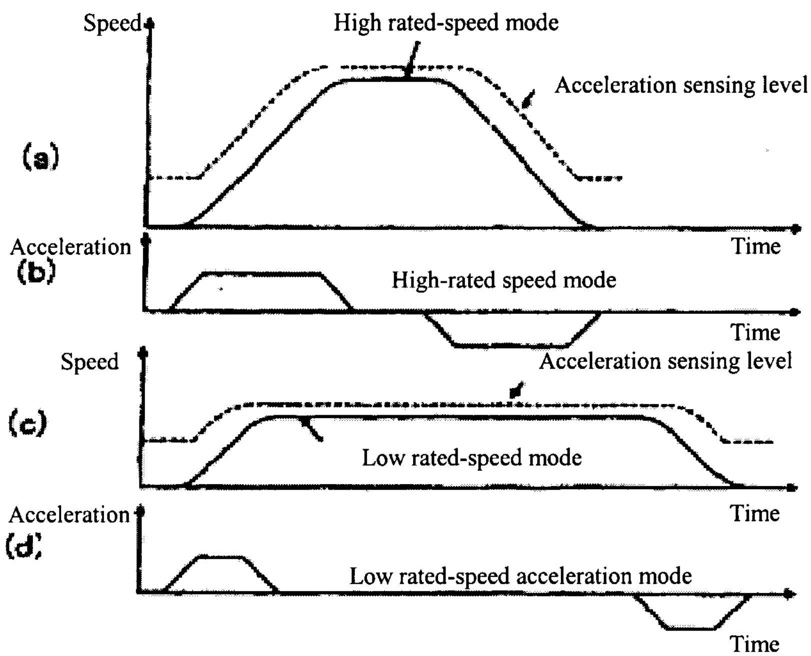
Speed
High rated-speed mode
Acceleration sensing level
(a)
Acceleration
Time
(b)
High-rated speed mode
Time
Speed
Acceleration sensing level
(c)
Low rated-speed mode
Acceleration
Time
(d)
Low rated-speed acceleration mode
Time

FIG. 11

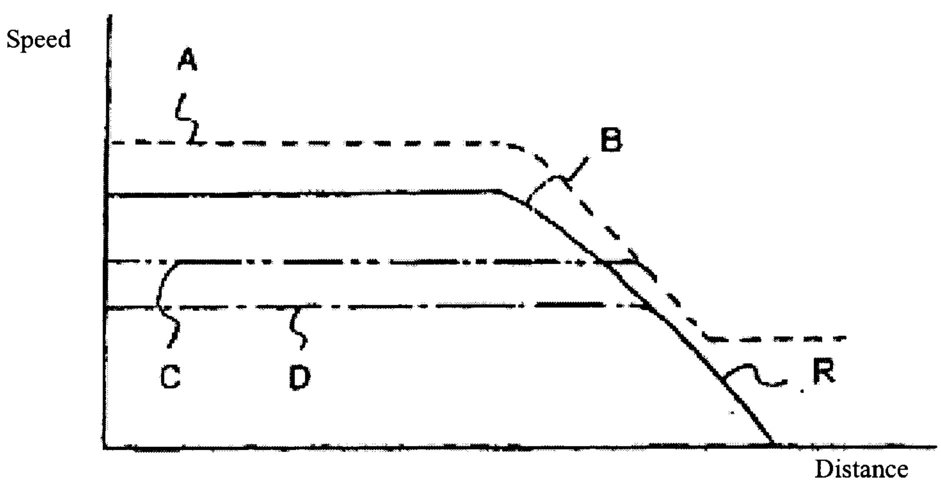
Speed
A
B
C
D
R
Distance

FIG. 12

D2

[19] 中华人民共和国国家知识产权局

[51] Int. Cl7
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[32] 2002.10. 1 [33] JP [31] 2002－288439

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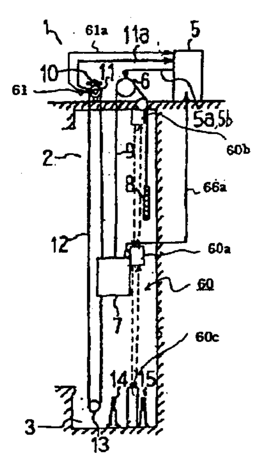
权利要求书2页 说明书7页 附图7页

[54] 发明名称 电梯的控制装置

[57] 摘要

本发明提供与从轿厢至终端的距离相对应地进行高精度设定加速度的终端阶段减速控制的电梯的控制装置。其具有检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置(60)、检测轿厢速度的速度检测装置(60)、由加速度水平检测轿厢加速度的加速度检测装置、在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而成为用所述加速度检测装置所确定的加速度水平以上时强制性地使轿厢减速停止的减速·停止装置，位置检测装置(60)连续地检测出轿厢离终端的距离，所述加速度检测装置与所述离终端的距离相对应而连续地使加速度水平可变。



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1、一种电梯的控制装置，其特征在于，具有：

检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置；

检测轿厢速度的速度检测装置；

由加速度水平检测轿厢加速度的加速度检测装置；

在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而成为用所述加速度检测装置所确定的加速度水平以上时、强制性地使轿厢减速·停止的减速·停止装置，

在终端阶段减速控制中，所述位置检测装置连续地检测轿厢离开终端的距离、并且所述加速度检测装置与所述离开终端的距离相对应而连续地使加速度水平可变。

2、如权利要求1所述的电梯的控制装置，其特征在于，所述位置检测装置和速度检测装置包含设在轿厢及升降通道中、将激光、声波、电波、光中的任一种作为检测媒体并直接对轿厢与终端的距离和轿厢速度进行检测的共用的检测部。

3、一种电梯的控制装置，其特征在于，具有：

检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置；

检测轿厢速度的速度检测装置；

由加速度水平检测轿厢加速度的加速度检测装置；

在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而成为用所述加速度检测装置所确定的加速度水平以上时、强制性地使轿厢减速停止的减速·停止装置，

在终端阶段减速控制中，所述位置检测装置离散地检测轿厢离开终端的距离，还具有对该离散性检测出的距离进行线形插补而连续获得距离的线形插补装置，并且所述加速度检测装置与线形插补的距离相对应而连续地使加速度水平可变。

4、如权利要求3所述的电梯的控制装置，其特征在于，所述线形插补装置对离散性检测出的离终端的距离之间用来自所述速度检测装置的速度积分值进行插补而连续地获得距离。

5、一种电梯的控制装置，其特征在于，具有：

控制电梯轿厢速度的速度控制装置；

对该电梯的速度进行指示的速度指令装置；

检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置；

由加速度水平检测轿厢加速度的加速度检测装置；

在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而成为由所述加速度检测装置所确定的加速度水平以上时、强制性地使轿厢减速停止的减速·停止装置；

根据额定速度调整指示信号而使电梯轿厢的额定速度可变至缓冲器的冲撞速度以上速度的额定速度可变装置。

6、如权利要求5所述的电梯的控制装置，其特征在于，所述额定速度调整指示信号是根据轿厢内负荷状态、轿厢的起动频度及来自外部的指示的任一种的信号，所述额定速度可变装置，根据所述额定速度调整指示信号可使额定速度上升或下降。

7、如权利要求5所述的电梯的控制装置，其特征在于，所述加速度检测装置将加速度水平限制于最大值，所述最大值根据额定速度可变。

8、如权利要求5所述的电梯的控制装置，其特征在于，在所述位置检测装置发生故障的场合，所述加速度检测装置将加速度水平降低至缓冲器的冲撞速度以下，所述减速·停止装置将轿厢的速度下降至由使所述速度指令装置产生的电梯的额定速度下降至缓冲器的冲撞速度以下的加速度水平所限制的速度。

9、如权利要求8所述的电梯的控制装置，其特征在于，还具有位置检验装置，其检验所述位置检测装置与所述速度指令装置具有的第2位置检测装置的配合性，并在发生与规定不一致时判断为故障、且所述额定速度可变装置使所述加速度检测装置的加速度水平下降。

电梯的控制装置

技术领域

本发明涉及电梯的控制装置，尤其涉及在终端阶段强制地对电梯进行减速停止控制的电梯的控制装置。

背景技术

设置在电梯的地坑中的缓冲器，在因故障等原因轿厢或配重全速地与缓冲器冲撞时也必须有能足够缓冲的行程。该行程，当额定速度增高时相应地变长，也必须相应地加深地坑。但是，当额定速度高至某种程度时，地坑的所需深度会成为不现实的数值。因此，实际上设置的深度比原来所需要的浅。

在以往的这种电梯的控制装置中，在至终端阶段前时设置多个动作点，在轿厢侧的位置检测开关对各动作点的升降通道侧的凸轮检测出的时刻，对加速度检测水平进行确认（例如，参照专利文献 1：日本专利特开平 11-246141 号公报）

在所述那样的电梯的控制装置中，由于用机械式开关对加速度进行检测，故阶段数受到限制，不能对轿厢的异常速度高精度检测加速度而在终端阶段不能强制地减速停止，且因加速度水平较粗并为将朝向缓冲器的冲撞速度抑制成限制值而存在着必须预先将制动转矩作成比通常要很大的问题。

发明的概要

本发明是为了解决上述问题而作成的，其目的在于，提供与从轿厢至终端的距离相对应的对加速度进行高精度设定的终端阶段减速控制的电梯的控制装置。

鉴于所述目的，本发明提供一种电梯的控制装置，具有：检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置；检测轿厢速度的速度检测装置；由加速度水平检测轿厢加速度的加速度检测装置；在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而在成为由所述加速度检测装置所确定的加速度水平以上时、强制性地使轿厢减速停止的减速・停止装置，在终端减速控制中，所述位置检测装置连续地检测离开终端的距离，所述加速度检测装置与离开所述终端的距离相对应地使加速度水平连续地可变。

附图的简单说明

图 1 是具有本发明的一实施形态的电梯的控制装置的升降通道的剖视图。

图 2 是表示在图 1 的控制盘内的计算机内所构成的终端阶段减速控制部的结构的功能方框图。

图 3 是用于说明本发明的电梯的控制装置的动作图。

图 4 是用于说明本发明的电梯的控制装置的动作图。

图 5 是具有本发明的另一实施形态的电梯的控制装置的升降通道的剖视图。

图 6 是表示图 5 的控制盘内的计算机内所构成的终端阶段减速控制部的结构的功能方框图。

图 7 是用于说明图 5 的离散的位置检测装置的结构图。

图 8 是用于说明图 5 的离散的位置检测装置的结构图。

图 9 是用于说明图 5 的离散的位置检测装置的结构图。

图 10 是表示在本发明的又一实施形态的电梯的控制装置中的控制盘内的计算机内所构成的控制部的结构的功能方框图。

图 11 是用于说明本发明的电梯的控制装置的动作图。

图 12 是用于说明本发明的电梯的控制装置的动作图。

发明的实施形态

[实施形态 1]

图 1 是具有本发明的一实施形态的电梯的控制装置的升降通道的剖视图。电梯基本上由机械室 1、升降通道 2 和设在升降通道 2 下部的地坑 3 构成，用控制盘 5 控制设在它们上的各设备。在挂在由来自控制盘 5 的控制信号 5a 和制动信号 5b 所控制的卷扬机 6 上的主索 9 的两侧上分别连接着轿厢 7 和配重 8。另外，具有与轿厢 7 的两侧连接并用张力轮 13 给予张力的调速机绳索 12 的调速机 10 设有由产生速度检测信号 11a 和移动量检测信号 61a 的各旋转编码器等构成的速度检测器 11 和移动量检测器 61。

在地坑 3 上分别具有缓和轿厢 7 和配重 8 冲撞的缓冲器 14、15。位置速度检测装置 60 包括设在轿厢 7 和升降通道 2 上的检测部 60a、60b、60c，作为检测媒体产生激光、声波、电波及光等而接收反射波，或利用此时的多普勒效应而直接检测出轿厢的离开上下终端的距离（轿厢的位置）及轿厢的速度。这就作成由位置检测装置 60 和速度检测装置 60 构成的装置。设在轿厢 7 上的检测部 60a 将检测信号 66a（作成包括距离和速度的信号）向控制盘 5 供给。图 2 表示在控制盘 5 内的计算机内所构成的终端阶段减速控制部 500。终端阶段减速控制部 500 具有本实施形态中的加速度检测装置 502 和减速·停止装置 504。加速度检测装置 502 是一般在轿厢的速度成为加速度水平以上时表

示检测出的加速度的装置，与由位置速度检测装置 60 的检测信号 66a 所连续检测出的轿厢离终端的距离相对应、连续地使加速度水平可变。减速·停止装置 504 在用与轿厢离终端的距离相对应的所述加速度检测装置 502 所确定的轿厢速度成为加速度水平以上时，使轿厢强制地减速·停止。另外，作为轿厢的速度信号也可以使用速度检测信号 11a 来代替位置速度检测装置 60 中的速度检测。

图 3 是用横轴作为时间表示随着电梯的运行而检测出的电梯的速度（用 A 表示）、连续地检测出的电梯的从轿厢至终端的距离（用 B 表示）、离散地检测出的电梯的从轿厢至终端的距离（用 C 表示）、和终端阶段减速控制装置检测出加速度并使制动器起作用而可减速成缓冲器 14、15 的容许冲撞速度以下的加速度检测水平（用 D 表示）的图。图 4 是将从轿厢至终端的距离取作横轴来表示相对于距离的通常减速曲线（用 E 表示）、相对于连续检测出从轿厢至终端的距离时距离的加速度检测水平（用 F 表示）、相对于离散性检测出从轿厢至终端的距离时距离的加速度检测水平（用 G 表示）的图。

本实施形态中的终端阶段强制减速控制，利用位置检测装置 60 来连续地检测出从轿厢至终端的距离。检测出的至终端的距离被送往控制盘 5 的终端阶段减速控制部 500，在终端阶段减速控制部 500 中，利用由加速度检测装置 502 与由位置速度检测装置 60 的检测信号 66a 连续地检测出的轿厢与终端的距离相对应、使加速度水平连续地可变。也就是说，对于比缓冲器 14、15 的最大额定速度高的额定速度的电梯，在与缓冲器 14、15 冲撞之前设定使轿厢速度降低的强制减速模式。减速·停止装置 504 使卷扬机 6 的制动器（未图示）动作，在成为用与从轿厢至终端的距离相对应的加速度检测装置 502 所确定的加速度水平以上时，强制地使轿厢减速·停止。由加速度检测装置 502 以加速度检测水平的最大值作为极限、对加速度水平进行限制，该最大值根据额定速度可变。

如上所述在本实施形态中，通过设定对于比缓冲器的最大额定速度高的额定速度的电梯在至与缓冲器冲撞之前使轿厢速度降低的强制减速模式，由于对用以往的少数的多个阶段的水平来进行的工作，通过使用将激光、声波、电波及光等作为检测媒体来使用的位置检测装置设定作成连续值，故能将使制动器动作的轿厢速度作成尽可能低的值，而能与从轿厢至终端的距离相对应地高精度地设定加速度。

[实施形态 2]

图 5 是具有本发明另一实施形态的电梯的控制装置的升降通道的剖视图。与所述实施形态相同或相当的部分用相同的符号表示。图 5 不是图 1 的位置

速度检测装置 60、而是具有由检测出从轿厢至终端的距离的、设置在升降通道 2 侧的板组 104~108 和由这些板组进行位置检测的、包括设在轿厢 7 侧的多个位置检测部（参照图 7~9 的 103a~f）在内的位置检测装置 102 构成的离散地检测电梯的轿厢位置的离散的位置检测装置 122。另外，距离检测装置 110 将由速度检测器 11 检测出的速度检测信号 11a 进行积分、算出运行距离并输出运行距离信号 110a。

另外，图 6 表示由在本实施形态中的控制盘 5 内的计算机构成的终端阶段减速控制部 500 的功能结构。终端阶段减速控制部 500 具有利用本实施形态中的加速度检测装置 502a、减速・停止装置 504a 和线形插补装置 111。线形插补装置 111 用距离检测装置 110 的运行距离信号 110a 对离散性检测出的从轿厢至终端的距离进行线形插补。加速度检测装置 502a 与来自离散的位置检测装置 122 的检测信号 102a 产生的离散性检测出的轿厢离开终端的距离相对应、而设置多个检测加速度的动作点、并与轿厢终端的距离相对应而离散地使加速度水平可变，而在这里，利用线形插补装置 111 与线形插补的距离相对应使加速度水平连续地可变。减速・停止装置 504a 在轿厢的速度成为用与从轿厢至终端的距离相对应的所述加速度检测装置 502a 所确定的加速度水平以上时，强制地使轿厢减速・停止。图 7~9 表示离散的位置检测装置 122 的板组 104a~108c 与位置检测装置 102 的位置检测部 103a~f 的关系，分别表示各自整体的主视图、处于结合状态的俯视图和主视图。图中表示了 5 点的动作点，但该点数可以是任意的，与其相应可增减位置检测装置 102 的位置检测部 103 和板组 104a~108c 的数目。

图 7 中，电梯的轿厢 7 沿升降通道 2 升降。将突设在水平方向上的臂 109a~109e 作成从下方的臂 109a 至上方的臂 109e 具有相同的长度。板 104a~104c、105a~105c、106a~106c、107a~107c、108a~108c，分别相对纸面垂直地被安装在各臂 109a~109e 上，并将各动作点进行编码。位置检测装置 102 的位置检测部 103a~103f 虽是利用磁性作用的构件，但也可以将其作成将激光、声波、电波、光等作为检测媒体的构件。位置检测部 103a~103f 如图 8 和图 9 所示，在各动作点将板 104a~108c 夹入（滑动插入）于形状为コ字形凹部中时，因磁性屏蔽而不动作，它们作为检测信号 102a 而产生，从成为该不动作的位置检测部 103a~103f 的组合，用图 6 所示的终端阶段减速控制部 500 检测到达至各动作点的情况。

图 3 中表示随着电梯的轿厢 7 的运行所检测出的电梯的速度 A、离散地检测出的从电梯的轿厢至终端的距离 C、图 4 中表示相对从轿厢至终端的距离的通常减速曲线 E、表示相对于离散地检测出从轿厢至终端的距离时的距离的加

速度检测水平 G、本实施形态的终端阶段强制减速控制利用离散的位置检测装置 122 离散地检测出从轿厢至终端的距离。另外，对利用速度检测器 11 检测出的速度进行积分、并利用算出运行距离的距离检测装置 110 检测出运行距离，利用线形插补装置 111（参照图 6）按运行距离对离散地检测出的从轿厢至终端的距离进行线形插补。在该线形插补中，将从检测出位置时离终端的距离作为基准距离，以后，例如利用在由速度检测信号 11a 所获得的速度数据的基础上所运算的运行距离，减去所述离终端的距离作为轿厢位置。

加速度检测装置 502a 根据线形插补、连续插补的至终端的距离检测出加速度，减速・停止装置 504a 作为卷扬机 6 的制动器（未图示）起作用，将可减速的加速度检测水平（参照图 3 的 D）连续地可变成缓冲器 14、15 的容许冲撞速度以下。加速度检测水平，用加速度检测装置 502a 按加速度检测水平的最大值作为极限对加速度水平进行限制，根据额定速度该最大值可变。

如上所述在本实施形态中，离散地检测出电梯的轿厢位置的离散的位置检测装置，由于作成对用线形插补装置所获得的该离散地检测出的距离进行线形插补而获得连续的距离、并与线形插补的距离相对应而作成连续地使加速度水平可变，故同样地能使制动器动作的轿厢速度作成尽可能低的值，可与从轿厢至终端的距离相对应高精度地设定加速度。

[实施形态 3]

图 10 表示由本发明的另一实施形态的电梯的控制装置中的控制盘 5 内的计算机构成的控制部 600 的功能结构。电梯的整体结构也可以是图 1、图 5 中的任一种。在图 10 中，速度控制装置 602，根据来自由指示电梯速度的图 1、图 5 的速度检测器 11 及移动量检测器 61、图 5 的距离检测装置 110 等构成的速度指令装置的信号来输出控制信号 5a 和制动信号 5b，并进行控制卷扬机 6 的通常的电梯轿厢的速度控制。加速度检测装置 604 对轿厢的速度与加速度水平进行比较而检测出轿厢的加速度。减速・停止装置 606 在轿厢接近升降通道的终端时、当轿厢的运行速度与离开终端的距离相对应成为由加速度检测装置 604 所确定的加速度水平以上时强制地使轿厢减速・停止。额定速度可变装置 608 根据后述的额定速度调整指示信号 300 使电梯轿厢的额定速度可变至缓冲器的冲撞速度以上的速度。另外，作为检测出从电梯升降通道的上下的终端至轿厢的距离的位置检测装置，也可以是图 1、图 5 的位置速度检测装置 60、离散的位置检测装置 122 或其他型式的装置。

额定速度调整指示信号 300，是根据轿厢内负荷（例如，轿厢内负荷轻的场合，以高额定速度模式运行；而在重的场合，以低额定速度模式运行行），或工作时间带的起动频度多的场合等，根据起动频度（例如，起动频度高的

场合，以高额定速度模式运行；而在少的场合，以低额定速度模式运行）的信号，或是乘客等从外部用推压按钮、开关等时（未图示）所获得的信号，是用于指示额定速度上升或下降的信号。图 11 的（a）中表示高额定速度模式，（b）中表示高额定速度加速度模式，（c）中表示低额定速度模式，（d）中表示低额定速度加速度模式。这里，额定速度作成高、低的 2 个阶段，但该阶段数也可以是几个。额定速度可变装置 608 根据额定速度调整指示信号 300 的指示而使额定速度可变。加速度检测装置 604 将加速度检测水平的最大值作为极限对加速度水平进行限制，该最大值根据额定速度可变。图 12 表示高额定速度时的加速度检测水平 A 和速度模式 B、低额定速度时的加速度检测水平 C 和速度模式 D。另外，R 表示通常运行时的减速曲线。

如上所述在本实施形态中，由于根据轿厢内负荷状态、起动频度或来自外部的指令、使电梯轿厢的额定速度可变至缓冲器的冲撞速度以上的速度，故通过将使制动器动作的轿厢速度作成尽可能低的值，使电梯可高效地运行。

[实施形态 4]

在利用本发明的又一实施形态的电梯的控制装置中，在由图 10 的控制盘 5 内的计算机构成的控制部 600 中，加速度检测装置 604 在由图 1、图 5 的位置速度检测装置 60、离散的位置检测装置 122 等构成的位置检测装置发生故障时，使加速度水平下降至缓冲器的冲撞速度以下，减速·停止装置 606 使轿厢速度下降至用将由图 1、图 5 的速度检测器 11 及移动量检测器 61、图 5 的距离检测装置 110 等所构成的速度指令装置产生的电梯额定速度下降至缓冲器的冲撞速度以下的加速度水平所限制的速度。

为了检测出故障，设有位置检验装置 610。位置检验装置 610，对利用由图 1、图 5 的位置速度检测装置 60、离散的位置检测装置 122 等构成的终端阶段减速控制的位置检测装置检测出的至终端的距离（与检测信号 66a、102a 对应）与由包含于速度指令装置中的移动量检测器 61 的移动检测信号 61a 算出的轿厢 7 的现在位置（与 61a 对应）进行比较，在产生规定值以上的差时，判断由位置速度检测装置 60、离散的位置检测装置 122 等构成的位置检测装置发生异常，并利用额定速度可变装置 608 使加速度检测装置 604 中的加速度水平下降至缓冲器的冲撞速度以下。

如上所述在本实施形态中，在位置检测装置发生故障的场合，加速度检测装置利用额定速度可变装置而使加速度水平下降至缓冲器的冲撞速度以下，并由于减速·停止装置使轿厢速度下降至用使速度指令装置产生的电梯的额定速度下降至缓冲器的冲撞速度以下的加速度水平所限制的速度，故能确保安全。

鉴于所述目的，本发明的电梯的控制装置，具有：检测从电梯升降通道的上下的终端至轿厢的距离的位置检测装置；检测轿厢速度的速度检测装置；由加速度水平检测轿厢加速度的加速度检测装置；在轿厢接近升降通道的终端时当轿厢的运行速度与离终端的距离相对应而成为由所述加速度检测装置所确定的加速度水平以上时、强制性地使轿厢减速停止的减速·停止装置，在终端阶段减速控制中，通过所述位置检测装置连续地检测离开终端的距离、并且所述加速度检测装置与离开所述终端的距离相对应地使加速度水平连续地可变，从而可提供将使制动器动作的轿厢速度作成尽可能低的值、与轿厢离终端的距离相对应而可高精度地设定加速度的电梯的控制装置。

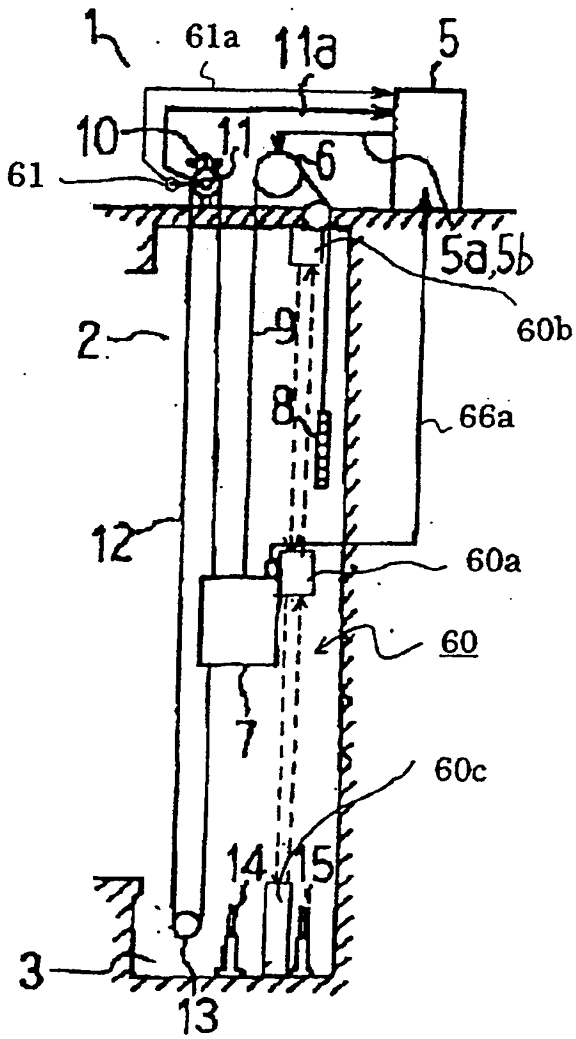
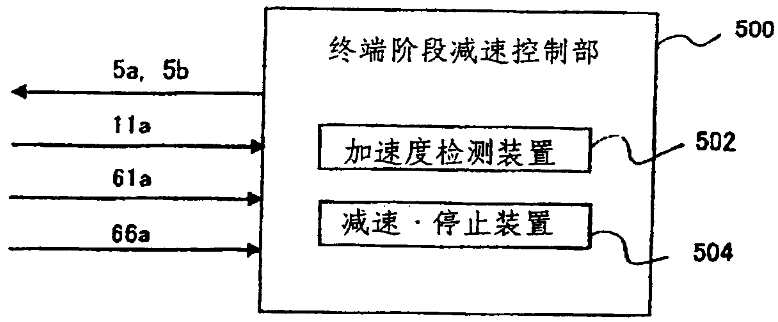
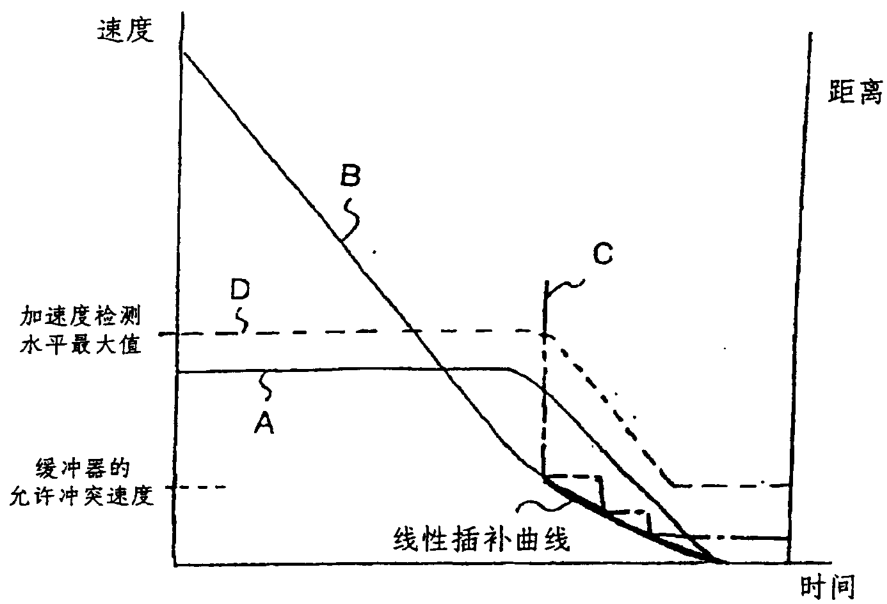


图 1



终端阶段减速控制部
500
5a, 5b
11a
61a
66a
加速度检测装置
502
减速・停止装置
504

图 2



速度
距离
B
C
D
加速度检测
水平最大值
A
缓冲器的
允许冲突速度
线性插补曲线
时间

图 3

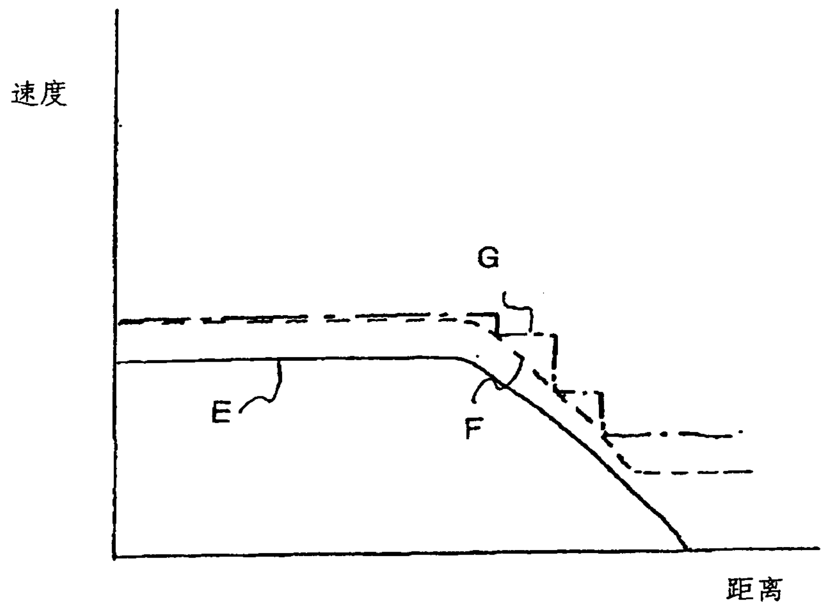


图 4

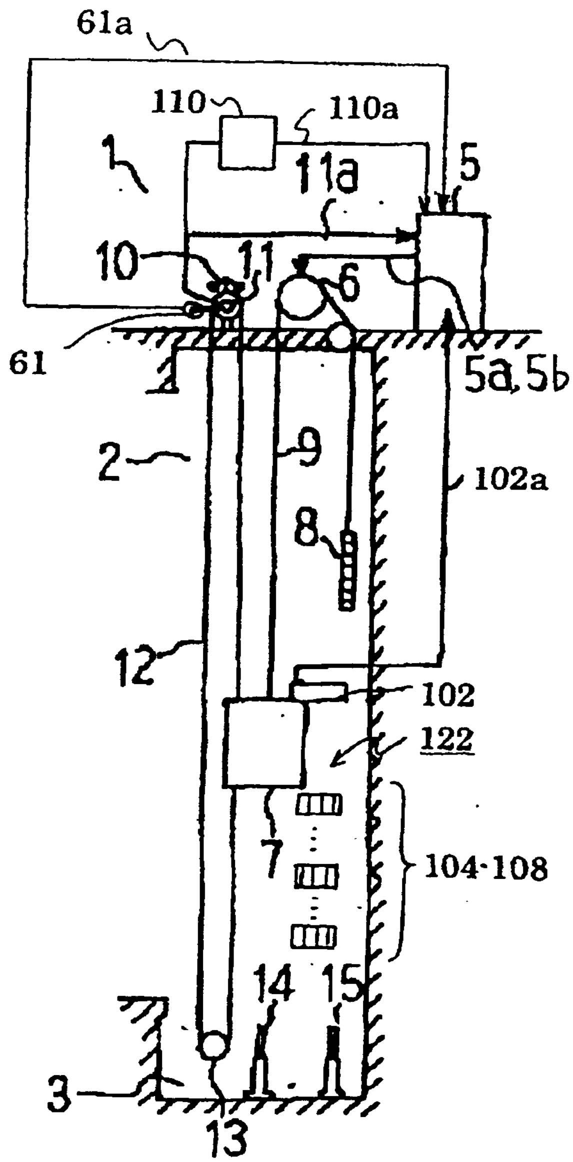

61a
110
110a
1
11a
5
10
11
6
61
5a,5b
2
9
102a
8
12
102
122
7
104-108
14
15
3
13

图 5

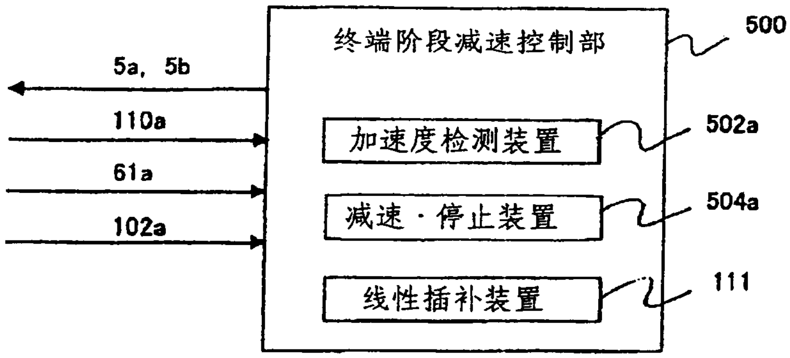

终端阶段减速控制部
500
5a, 5b
110a
61a
102a
加速度检测装置
502a
减速・停止装置
504a
线性插补装置
111

图　6

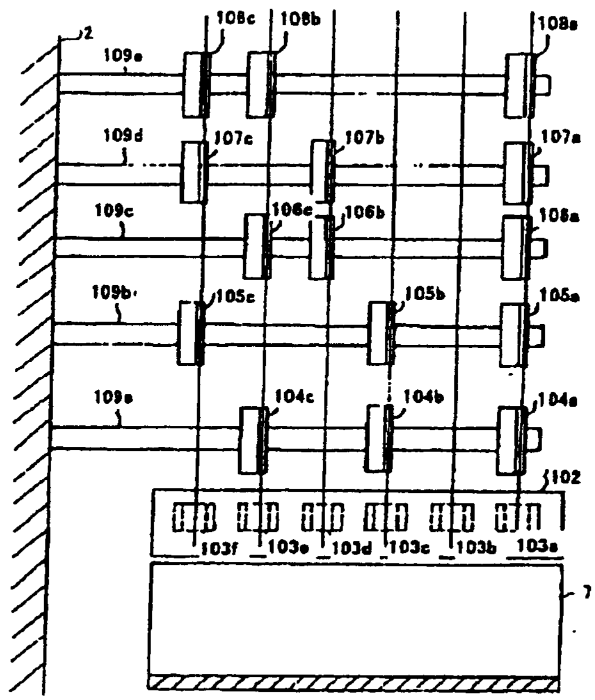

108c
108b
108a
2
109e
109d
107c
107b
107a
109c
106c
106b
106a
109b
105c
105b
105a
109a
104c
104b
104a
102
103f
103e
103d
103c
103b
103a
7

图　7

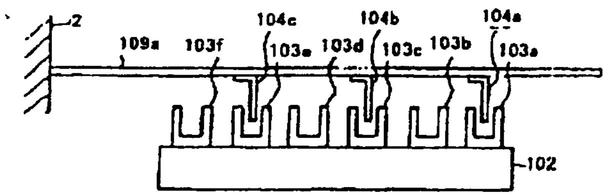

2
109a
103f
104c
103e
103d
104b
103c
103b
104a
103a
102

图 8

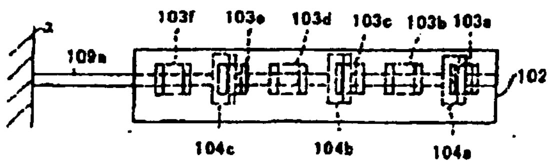

2
109a
103f
103e
103d
103c
103b
103a
102
104c
104b
104a

图 9

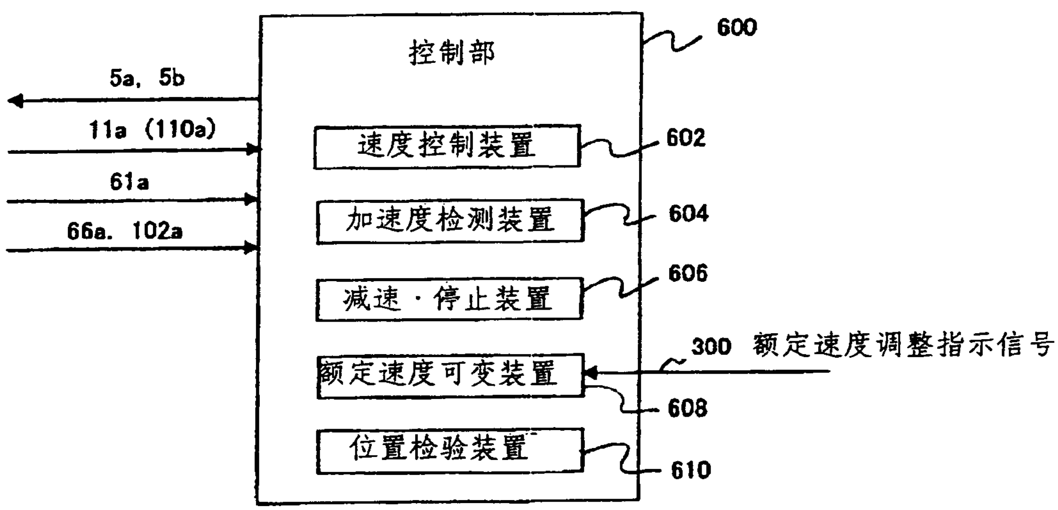

控制部
600
5a, 5b
11a (110a)
61a
66a. 102a
速度控制装置
602
加速度检测装置
604
减速·停止装置
606
300 额定速度调整指示信号
额定速度可变装置
608
位置检验装置
610

图 10

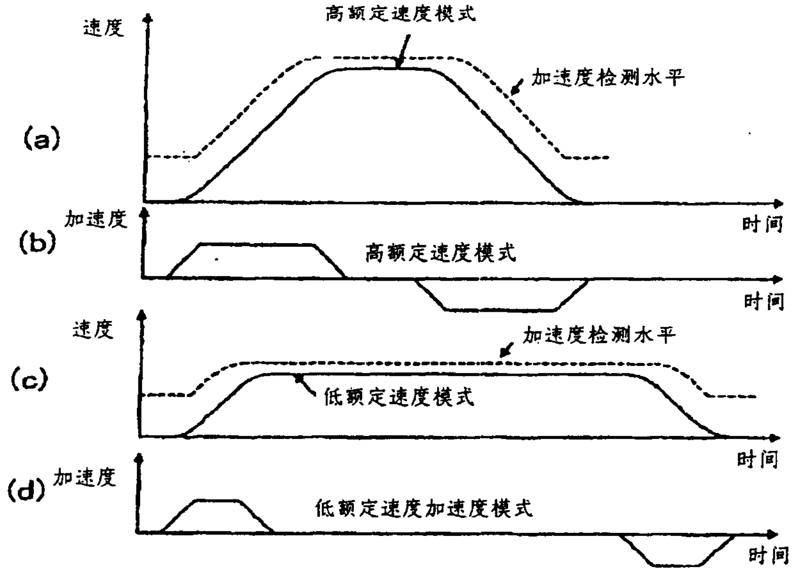

速度
高额定速度模式
加速度检测水平
(a)
时间
加速度
(b)
高额定速度模式
时间
速度
加速度检测水平
(c)
低额定速度模式
时间
(d)
加速度
低额定速度加速度模式
时间

图 11

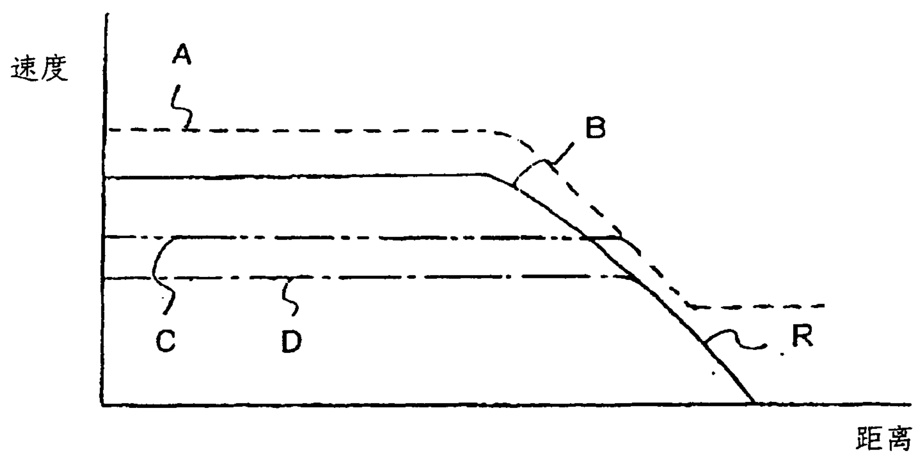

速度
A
B
C
D
R
距离

图 12